3.0 OPERATIONAL CONSIDERATIONS DURING DREDGING

The primary objectives of site management during dredging operations are: (1) to maintain acceptable effluent quality during the decanting process; and, (2) to maximize the dewatering rate of the deposited material by controlling the pattern of deposition. To this end, four elements of site management are discussed. The first addresses the placement and handling of pipelines to and from the containment area. The second examines the operation and monitoring of the pipeline inlets. Site operational guidelines and procedures included here are intended to promote the efficient operation of the material management facility, and to ensure that effluent water quality standards are met. The third site management consideration addressed, and the one most critical for determining the quality of effluent released from the material management facility, is weir operation. Lastly, a monitoring program is presented to ensure that the operation of the containment area does not degrade the shallow aquifer groundwater in the immediate vicinity of the site.

3.1 Placement of Pipelines

Each dredging operation over the design life of the BV-2C material management facility will require the placement and retrieval of both supply and return pipelines. The route to be used for this purpose is shown in Figure 2-1. The pipelines will lie within a 60 foot wide easement, approximately 600 feet in length, which intersects the site boundary near the southeastern property corner. Within the site boundaries, the supply pipeline will parallel the perimeter ditch, lying between the ditch and the perimeter road along the eastern and northern sides of the containment dike. At the northwest corner of the containment dike, the supply pipeline will pass over the dike crest and enter the basin. The return pipeline will connect to the weir/manifold system near the southeastern corner of the containment dike, and continue to the MHW shoreline of the Indian River within the easement described above.

The pipelines will be placed immediately prior to the commencement of dredging, and will remain in place until the completion of dredging and dewatering operations. The time required to complete the dredging phase of operations will depend on the quantity and distribution of the material to be dredged. The average bulked volume of material produced in a single maintenance dredging operation (474,327 cy) corresponds to an in-situ (unbulked) volume of 220,617 cy. Based on project planning guidelines used by the Jacksonville District Corps of Engineers, an 18-inch dredge will most likely be used, with a discharge velocity of 16 ft/sec, a volumetric discharge rate of 3,560 cy/hr, and a

20/80 solids/liquid slurry mix. Applying these values to the in-situ material volume of 220,617 cy, yields an effective dredging period of approximately 310 hours of continuous operation. However, because of typical delays associated with dredging projects, it is more realistic to assume that the entire dredging operation will require approximately 4 weeks to complete. Immediately upon completion of dredging, the dredge discharge pipeline will be removed. An additional 4 weeks will then be required to decant all ponded water over the weirs. This would also include the removal of any water released by initial trenching procedures, if required. At this point, the return water pipeline would also be removed. Ponded rainwater, collected in the containment area, will subsequently be removed via the weir system so that any suspended sediment will be retained. However, unlike the clarified effluent removed during dredging operations, the rainwater will be routed to an appropriate discharge point via a culvert/ditch system. The removal of run-off is discussed further in Section 4.2.1.

3.2 Inlet Operation

The operation of the inlet pipe will be primarily determined by the physical characteristics of the sediment to be dredged. The analysis of containment area solids retention performance presented in Section 2.3.3 is based on assumed characteristics of the sediment to be dredged in Reach I, and reflects the experience and recommendations of the Jacksonville District Corps of Engineers. A conservative estimate of the fine sediment fraction of this material was used to ensure a conservative containment basin design. However, specific data characterizing the material will be obtained prior to future dredging operations. These data will include, as a minimum, core boring logs and a qualitative categorization of each strata of sediment, laboratory data including sediment size distribution curves and/or Atterberg limits, and suspended sediment-settling time curves from each boring location.

Subject to this event-specific information which characterizes the quality of the sediment to be dredged, the following strategy of inlet operation within the containment basin is recommended. It conservatively assumes that the dredged material is predominantly fine sand with components of fine grained sediment, and includes some organics. It makes no attempt to segregate material grain size fractions by manipulation of the inlet. Some segregation will occur naturally as a result of differential settling behavior, with the coarsest fraction settling out of suspension very rapidly, forming a mound in the area of the inlet. Successively finer fractions, characterized by lower settling velocities, will then be deposited closer to the outlet weirs. The deposition of the finest fraction nearest the weirs is not expected to require intensive dewatering procedures because of the thin lift approach employed. The position of the inlet will be moved during dredging operations, but only to minimize the mounding of the coarser fraction of sediment, and to distribute the deposited material more uniformly. For the BV-2C material management area, this will entail a progressive southeasterly extension of the supply pipeline from the point where it enters the containment area, resting each extension on the mound formed by the previous inlet position. A minimum distance of 100 feet must be maintained between the inlet and the inside toe of the dike to preclude erosion or undercutting of the interior dike slope. The resulting pattern of deposition will maintain a consistent slope from inlet to weir, minimize dead zones and channelization, and will reduce the requirement for grading the deposited material to re-establish the desired 0.1 percent slope between successive disposal operations.

An additional, although secondary, advantage to be gained through extending the inlet pipeline in the above described manner comes as a result of the dredge plant being necessarily shut-down to allow each extension section to be added. These operational intermissions, together with temporary shutdowns to move the dredge, effectively increase the retention time of the containment area, thereby increasing the solids retention efficiency of the basin. It should be noted, however, that a preliminary analysis of containment area performance indicates that adequate effluent quality can be attained without requiring intermittent dredge operation.

3.2.1 Monitoring Related to Inlet Operation

During active dredging operations, several monitoring procedures related to inlet operations will be required. Ponding depth, as previously mentioned, is a critical parameter for the optimization of containment area performance. It is desirable to maintain as great a ponding depth as possible, thereby increasing retention time, solids retention, and effluent quality. However, unbalanced hydrostatic forces resulting from too great a ponding depth under saturated foundation conditions can lead to slope instability, slumping, and the potential for dike failure. Obviously, the latter situation must be avoided at all costs. Therefore, ponding depth should only be increased above the 2.0 foot minimum under close monitoring by visual inspection of dike integrity. Indications of impending instability include evidence of foundation saturation and seepage at the outer dike toe, and small-scale slumping. If no effluent is released at the weirs, the design dredge output (i.e., 6,430 cy/hr slurry at a 20/80 solids/liquid mix, or 5,144 cy/hr liquid) will produce an increase in ponding depth of 0.29 in/hr, and a rise in the water surface (i.e. deposition layer plus ponding) of 0.36 in/hr. These rates are slow enough to allow close continual monitoring of the entire dike perimeter. However, ponding depth should not be permitted to increase beyond a maximum of 5 feet. Continuous monitoring of dike stability should be performed during periods when ponding depth is maintained above the 2 foot minimum.

Optimal containment area operating efficiency requires that flow through the basin approximate plug flow to the greatest degree possible, thereby minimizing the uneven distribution of flow velocities and sediment re-suspension, and maximizing retention time. Therefore, the pattern of sediment deposition should be monitored for indications of irregular distribution, channelization, and short-circuiting. If evidence of such anomalies is found, the inlet pipe should be repositioned until a more uniform depositional surface is formed.

Lastly, the dredge plant output should be periodically monitored at the slurry outfall within the containment area throughout dredging operations. The purpose of this monitoring is to confirm or refine dredge output specifications, including volumetric output and slurry solids content. These parameters, in combination with the duration of actual dredge operation, can be used as an independent measure of deposition volume for purposes of determining remaining site capacity. Additionally, the computed deposition volume can be used with pre- and post-dredging bathymetric surveys of the channel, and topographic surveys within the containment area following placement and dewatering of the deposition layer, to refine the bulking factor employed to translate in-situ dredging volume to required containment volume. Also, within the same monitoring program the quality of dredged sediment should be examined by typical techniques of soils analysis including the establishment of grain size distributions, settling velocities, specific gravity, and Atterberg limits, if appropriate. The results of this monitoring and analysis, together with measures of effluent quality, to be discussed in the following section, provide a basis for the operational management of containment area performance and efficiency.

3.3 Weir Operation

Once the containment area is constructed and dredging operations have begun, the most effective way to control effluent quality is by changing ponding depth and rate of flow over the weir through adjustments in the weir crest elevation. Prior to the commencement of dredging, the weir crest elevation should be set as high as possible to preclude the early release of effluent. The maximum initial elevation of the weir crest above the mean interior site grade should be equal to the maximum anticipated mean ponding depth of 5.0 feet. For the BV-2C material management area, this will result in an initial weir crest elevation of +7.40 ft NGVD, or 5.95 feet above grade at the weirs, given an initial containment basin interior slope of 0.1 percent, a distance from inlet to weir of 2,900 feet and a 0.5 feet weir operational head. As the deposited material reaches the base of the weirs, the weir crest elevation should be increased at approximately the same rate as the growth of the deposition layer. With the average depth of deposition per event projected to be 2.25 feet, maintaining a mean ponding depth of 5.0 feet (6.45 feet at the weirs) will result in a weir crest elevation at the completion of dredging of approximately +9.65 ft NGVD.

Once dredging begins, the weir crest should be maintained at its initial elevation until the ponded water surface approaches the weir crest. During this initial phase of operation in which no effluent is released, the discharge of the dredge plant will result in an increase in ponding depth of approximately 0.29 in/hr, and an increase in the ponded water surface elevation (ponding depth plus deposition layer) of 0.36 in/hr. This relatively slow rise should allow for close continual monitoring of the entire dike perimeter for indications of slope instability, as discussed in the previous section. Inspection is most critical during the initial phase of operations, and during subsequent periods when the ponded water surface is raised above its previous maximum elevation. Experience has shown that as the ponded water percolates into the interior dike slope, the fine suspended sediment is filtered by the coarser dike material. This reduces the permeability of the dike and decreases the susceptibility of the dike to piping and saturation.

As ponding depth increases above the 2 foot minimum design depth (or approximately 3.45 feet at the weirs), release of the supernatant can begin. It is important to note that the weirs are only flow control structures and therefore cannot improve effluent quality beyond that of the interior water. Thus, the decision to release must be based on the results of turbidity testing or suspended sediment concentration analysis conducted on the surface waters inside the weirs. These tests must reflect conditions at the maximum depth of withdrawal. For the BV-2C material management area this was determined from recommended WES procedures to be 2.11 feet, based on a design weir loading of 1.07 cfs/ft. If adequate water quality is not achieved prior to the ponded water surface reaching the initial weir crest elevation, the dredge plant must be shut down until the surface water turbidity reaches acceptable limits, or until alternative measures such as the installation of turbidity screens or floating baffles around the weirs are implemented. If the desired water quality is achieved at a ponding depth less than the initial weir crest elevation, the water surface should still be permitted to rise to the weir crest provided that dike integrity is not threatened.

Once flow over the weirs has begun and effluent of acceptable quality is being produced, the static head over the weir becomes the most readily used criterion for weir operation. The static head represents the elevation of the water surface above the weir crest as measured upstream of the weir at a point where velocities are small (1 to 2 percent of the weir loading rate). For a design weir loading of 1.07 cfs/ft, the corresponding operational static head is 0.48 feet or 5.8 inches, based on an empirical relationship developed for sharp-crested weirs.

The actual operating head over the weir can be measured on site by two methods. First, it can be determined by using a stage gauge, located in the basin where velocities caused by the weir are small (at least 40 to 50 feet from the weir). The elevation of the water surface can be read directly from the gauge, with the difference between the gauge elevation and the elevation of the weir crest indicating the static head. The static head can also be determined indirectly by measuring the depth of flow over the weir. The ratio of depth of flow over the weir to static head has been shown to be 0.85 for sharp-crested weirs, yielding a design depth of flow for the BV-2C facility of 0.41 feet or 4.9 inches. If the head over the weir, as measured by either method, falls below these design values as a result of unsteady dredge output or intermittent operation, effluent quality should increase. However, if the head exceeds these values, ponding depth should be increased by adding a flash board, or dredging should be interrupted to prevent a decrease in effluent quality.

At all times, each of the four weir sections must be maintained at the same elevation to prevent flow concentration and a decrease in effluent quality related to an increase in weir loading. It is also important to prevent floating debris from collecting in front of the weir sections. This will result in an increase in the effective depth of withdrawal and a corresponding increase in effluent suspended solids concentration.

After dredging has been completed, the ponded water must be slowly released, allowing the flow over the weir to drop essentially to zero before the next flash board is removed. Monitoring of effluent quality should continue during this process and if turbidity violates water quality standards the effluent must be retained until analysis of the interior surface waters indicates the suspended solids concentration to be within acceptable limits. The decanting process should then continue in this manner until all ponded water is released over the weirs. Trenching and other dewatering techniques are considered post-dredging procedures and are discussed in Section 4.0.

3.4 Monitoring of Effluent

The monitoring of effluent released from the BV-2C material management area will be an integral part of the operation of the facility. The containment area has been designed to produce effluent which meets the water quality standards for Class II waters as set forth in Chapter 17-302 of the Florida Administrative Code. These rules require that site compliance be documented by results obtained from a comprehensive monitoring program. Therefore, the monitoring program should be in place at all times during active dredging operations. The minimum recommended sampling frequency is two times per eight hour shift.

Although effluent turbidity is but one of 29 parameters addressed in the Florida state water quality standards, compliance with these standards has been historically based on turbidity alone for several reasons. To begin, turbidity can be reliably measured in the field, and is the only water quality parameter over which the containment area operator may exercise direct control. Moreover, turbidity is a strong indicator of general effluent quality since many contaminants, most notably metals, exhibit a strong affinity for fine particles. Thus, reducing turbidity should result in an overall improvement in effluent quality.

It is recognized, however, that the disturbance of contaminated sediments may result in the release of other pollutants, predominantly nutrients and hydrocarbons, which do not necessarily associate with fine particles. Thus, if the in-situ sediments contain elevated levels of these contaminants, turbidity may be a superficial indicator of effluent quality. Monitoring of effluent should therefore be based on the results of comprehensive elutriate and dry analysis of the sediment to be dredged prior to the commencement of dredging. Testing required under the effluent monitoring program should then focus on those contaminants whose presence in the sediment has been established.

Because effluent turbidity is a key indicator of operational effectiveness, compliance with turbidity standards will control both the dredge plant output and the release of effluent. State turbidity standards are expressed in terms of nephelometric turbidity units (NTU), which measure the optical transparency of the effluent relative to the optical transparency of the receiving waters. Containment area design guidelines published by the U.S. Army Corps of Engineers Waterways Experiment Station (WES) under the Dredged Material Research Program (DMRP) relate containment area performance to the suspended solids concentration of the effluent. The translation of solids concentration (e.g. grams of suspended solids per liter of fluid) to a measure of turbidity is highly dependent on the characteristics of the suspended material. It would therefore be very useful for the operation of this facility, as well as the design and operation of other similar facilities, to use the results of the effluent monitoring program in combination with known sediment characteristics to relate suspended solids concentration to the state performance criterion of turbidity or transparency. This should be a primary objective of the BV-2C dredged material management area monitoring program.

3.5 Groundwater Monitoring

Two factors make the occurrence of unwanted chloride contamination at the BV-2C material management area unlikely. First, a system of perimeter ditches surrounding the containment basin will be constructed to limit the horizontal migration of saltwater from the containment basin. As discussed in Section 2.3.6, these ditches will extend below the depth of excavation of the basin interior, and will intercept any seepage from the containment basin, draining it back to the Indian River. Second, the BV-2C containment basin will impound brackish water pumped from the ICWW in connection with dredging operations for relatively short periods of time (on the order of 8 weeks), no more than once every 5 to 10 years. Thus, the risk of saltwater contamination of adjacent groundwater is considered minimal.

Nevertheless, because of the possibility of impacts on local groundwater and its usage (i.e. citrus cultivation, both on-site and on adjacent properties), a monitoring program will be initiated prior to the commencement of construction or dredging operations. Initially, a subsurface survey will be conducted to determine the location of the on-site water table, followed by the placement of shallow test wells within the planned on-site buffer region which separates the containment basin from adjacent properties. Baseline chloride concentrations will then be determined for preconstruction conditions, and a regular monitoring program will be established to document any deviations from these conditions. It should be noted that continuing significant demands placed by adjacent properties on local groundwater supplies could also result in the direct intrusion of salt water from the Indian River. Therefore, it is important that an ongoing well monitoring program be kept in place throughout the design life of the site to distinguish any changes in chloride concentrations which are attributable to site operations.

4.2 Grading the Deposition Material

If the inlet placement strategy discussed in Section 3.2 results in a deposit of fine material of sufficient thickness (greater than 1-2 feet) to allow efficient removal by conventional equipment, this should be done prior to grading. Removal of the fine material at this time offers several advantages. The primary advantage is the segregation of that fraction of sediment which is least desirable for recovery and re-use, thereby rendering the remaining coarser material more marketable. Removal of the fine sediment also prevents the subsequent formation of a depression near the weirs as the finest-grained material which concentrates in this area continues to consolidate under pressure from succeeding deposits.

Grading of the deposition layer should begin as soon as possible following either the completion of dewatering operations or the removal of the fine grained fraction, if appropriate. The grading should consist primarily of distributing the mounded coarser sediment (sand, shell, gravel, etc.) over the remainder of the containment area so as to re-establish the initial uniform 0.1 percent downward slope from inlet to weir.

The grading of the dewatered deposition layer is essential for the control and release of stormwater runoff. A shallow, uniform slope toward the weirs will ensure adequate drainage and eliminate the ponding of runoff in irregular depressions. It will also minimize flow velocities and the risk of channelization and erosion. In compliance with regulatory policy, a sump or retention area of adequate capacity to retain the runoff from the first one inch of rainfall should be constructed adjacent to the weirs. For the BV-2C containment basin interior area of 144.86 acres (from the dike crest centerline inward), a retention pond with a minimum capacity of approximately 525,859 ft^3 will be required. This capacity can be provided by a circular basin with a radius of 237 feet and an average depth of 3.0 feet. A site operator would then be responsible for the gradual release of the ponded runoff at intervals to be determined by local weather conditions. It may also be necessary to provide shallow trenches or swales from the center of the retention basin to one or more weir sections so that the runoff may be quickly and completely released.

4.3 Material Rehandling/Reuse

As discussed in Section 1.0, the BV-2C dredged material management area is one of eight proposed facilities designed to serve the long-term maintenance requirements of the Intracoastal Waterway within Brevard County. Throughout this report, as well as the accompanying permit documentation, it has been emphasized that although each facility has been designed for a specific service life, it is to be operated as a permanent facility for the intermediate storage and re-handling of dredged material. Due to the limited capacities of the dredged material management areas in Brevard County (including BV-2C), the dewatered material must be removed for the continuation of operations beyond the 50 year design life of the facility. Therefore, it is essential to develop a plan of action to deal with this material and its ultimate use as discussed in the following paragraphs.

Based on a comprehensive analysis of dredging records, the bulked disposal volume over the 50-year design service life of the eight Brevard County facilities is projected to be seven million cubic yards of predominantly fine to medium quartz sand. Although relatively minor by the standards of some dredging operations, this volume still represents a significant quantity of potentially valuable construction material. Even if the possible return on the sale of this material were disregarded, the savings on the cost of permanent storage alone would justify a concentrated effort on the part of the State of Florida to determine through a formal market analysis the potential demand for dewatered dredged material.

If such an analysis determines that material resale and/or reuse is practical, it must then be demonstrated that the material properties satisfy the requirements of commercial interests. It is anticipated that much of the material can be used 'as is', having been partially segregated through differential settling. However, the feasibility of compartmentalized segregation of material during dredging or mechanical separation following dewatering should be explored if market conditions dictate. Portions that are determined to be unsuitable for fill or other construction purposes might be used as capping material for landfills, or for agricultural purposes.

If the market analysis determines that resale or reuse is not feasible, it will be necessary to locate and develop a centralized permanent storage facility. The appropriate location for such a facility would appear to be inland, where lower real estate values and development potential make permanent storage more economically feasible. The optimal distance from the initial containment area to the permanent storage site would represent a compromise between lower land costs and higher transportation expense.

4.4 Monitoring of Containment Area Performance

Several monitoring programs relevant to site management between successive dredging operations have already been discussed. These include the monitoring of shallow aquifer groundwater for evidence of elevated chloride concentrations, and the analysis of the stormwater runoff effluent released over the weirs. These programs should continue throughout the service life of the site, although the sampling interval between active dredging operations may be extended to coincide with regular site inspections required to maintain security.

Additional site monitoring in the form of topographic surveys of the containment area deposition surface is also recommended. These surveys consist of three basic types. The first is a post-dredging survey which should be performed as soon as possible following the completion of material dewatering operations and initial grading of the deposition surface. From this, a refined estimate of the quantity of material deposited can be obtained. The second type of topographic survey would follow the completion of material removal and related grading operations. Results from this survey would be used to compute the quantity of material removed and the remaining site capacity. The third type of recommended topographic survey is referred to here as a pre-dredging survey. During periods in which no material is removed between dredging events this survey would be performed prior to the commencement of dredging operations. Results obtained, in combination with information obtained from the previous post-dredging survey, can be used to determine the amount of material consolidation which has occurred, and to compute remaining site capacity.

In conjunction with the monitoring of material consolidation, a series of core borings taken after the completion of de-watering would further define the progress of consolidation while providing a means to determine the engineering properties of the dewatered material and its suitability for re-use. Samples should be analyzed for grain size distribution, Atterberg limits, moisture and organic content, and other factors which may affect the marketability of the material.

4.5 Monitoring of Habitat and Vegetation

As shown in Figure 4-1, much of the BV-2C property is vegetated by citrus groves, fallow cropland, herbaceous rangeland, and temperate hardwoods. However, numerous wetlands are interspersed throughout the eastern portion of the site. Of the 78.1 acres of wetlands on site, 8.9 acres

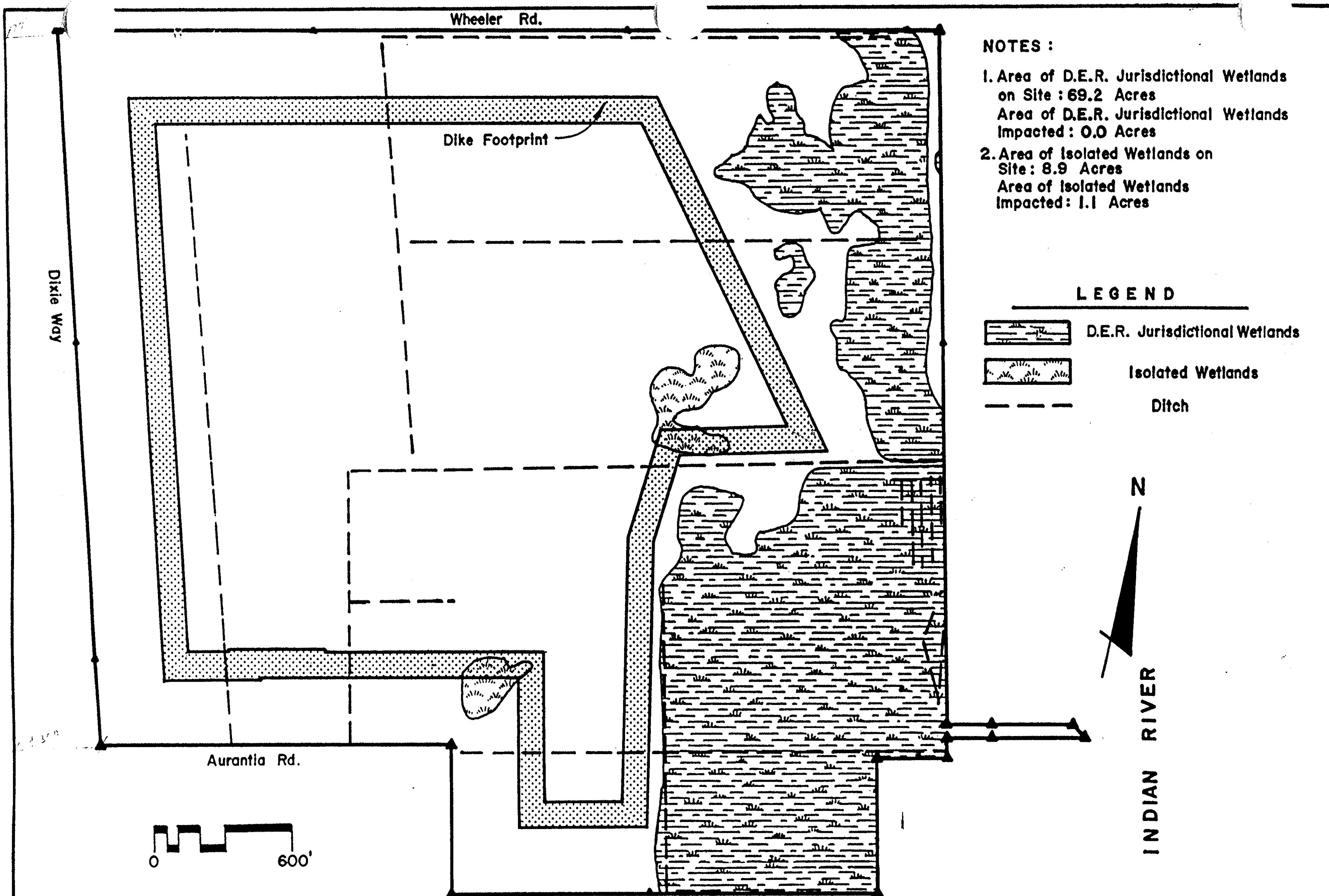

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Figure 4-1
Wetlands Map
BV-2C Dredged Material Management Area, Brevard County, Florida

PROJECT	C-9004
REVISION	
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DATE	Aug. 1992

are isolated, while 69.2 acres are connected to the waters of the State and are therefore subject to the review and permitting authority of DER. The material management area has been configured such that all of the DER jurisdictional wetlands lie within the buffer area. Despite the environmental considerations which have gone into the design of BV-2C, and the attempt to limit construction and dredging operations to the area of the containment basin and surrounding ditches, the possibility exists that these wetlands may be impacted. Therefore, a environmental survey of the site will be completed prior to any construction to establish baseline habitat and vegetation conditions as they relate to the wetlands. Periodic re-surveys should then continue throughout the service life of the site. Degradation of the wetlands related to the interruption of natural drainage patterns, groundwater impacts, or other possible consequences of site construction or operations should be noted, corrective actions taken, and guidelines developed to minimize further adverse impact.

4.6 Joint Use of the Buffer Area for Citrus Production

It is anticipated that the former owners of the property will continue production of citrus crops within portions of the BV-2C buffer area. However, at the time of this writing no formal agreement has been reached. Pertinent sections of such an agreement, if consummated, will be incorporated into the BV-2C Site Management Plan following the finalization and execution of the agreement document.

4.7 Mosquito Control

The basic approach of the mosquito control program for the BV-2C material management area will be physical control through the minimization of periods during which standing water exists inside of the containment area. The phase of site operation which provides conditions most favorable for mosquito breeding occurs during the dewatering of sediment when desiccation cracks form in the crust as the fine sediment deposits shrink through evaporative drying. Trenching procedures (Section 4.1) will accelerate the dewatering process by allowing much of the moisture within the cracks to drain to the weirs. However, adverse climatological conditions could delay dewatering long enough to result in successful mosquito breeding within the desiccation cracks. This would require a short-term spray program coordinated through the Brevard County Office of Environmental Services.

4.8 Site Security

A key element in the proper management of the BV-2C dredged material management area is the provision of adequate site security. Historically, these areas have been subject to a variety of unauthorized activities including illegal dumping, vandalism, hunting, and the destruction of dikes through the use of off-road vehicles. The occurrence of such activities on Site BV-2C will be controlled by the installation of security fencing along the property boundary. This will restrict the entry of unauthorized parties throughout the design life of the site. If deemed necessary to maintain adequate security, a second inner fence surrounding the containment dikes and perimeter ditches will be installed. In this manner, material management area security can be maintained while the grove areas are being accessed.

The presence of an on-site operator during all phases of active dredging and de-watering operations should further discourage unauthorized entry to the site and the occurrence of non-sanctioned activities. Between dredging operations the site operator will be responsible for carrying out regularly scheduled inspections. The primary purpose of these inspections will be to perform routine operational functions, and to ensure that the security of the facility is maintained. Breaches in site security will be identified and appropriate actions will be taken as quickly as possible to restore the site to a fully operational standby condition. Other responsibilities of the operator during these visits will include weir operation and stormwater release, monitoring of stormwater effluent quality and groundwater monitoring wells, as well as the performance of routine inspections of dike integrity and buffer area conditions.

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